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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/838,493	04/19/2001	Dinesh Chopra	303.658US1	8948

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EXAMINER	
NGUYEN, KHIEM D	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 10/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/838,493	
	Examiner	Art Unit
	Khiem D Nguyen	2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-57 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-11,15-24,28-32,34,36-44,46 and 48-57 is/are rejected.

7)☒ Claim(s) 12-14,25-27,33,35,45 and 47 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 19 April 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-57 in Paper No. 4 is acknowledged.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693) in view of Ho et al. (U.S. Patent 6,261,954).

Lu teaches a method of metallizing a substrate, comprising (See page 1, paragraph [0012] to page 2, paragraph [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 comprises a material capable of reducing diffusion of the conductive interconnect material into surrounding materials (See Paragraph [0017]), and wherein the dual-purpose layer comprises a material having a resistivity that allows electrochemically deposition of the conductive interconnect material (See paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer (See paragraph [0019]; and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer (See Paragraph [0022]).

Lu fails to teach wherein the dual-purpose layer comprises tungsten as recited in present claims 3-4.

Ho teaches a dual-purpose layer 18 comprises tungsten. (See col. 3, lines 30-41 and FIG. 6). ***It would have been obvious to one of ordinary skill in the art of making semiconductor devices*** to incorporate Ho's teaching into Lu's method because in doing so the dual-purpose layer comprises of tungsten can eliminate out-diffusion of copper ions from the interconnect (See col. 3, lines 30-41).

Lu fails to teach the ranges of the voltage and current applied during both the electrochemically reducing and depositing step as recited in present claims 6-9.

However, it would have been obvious to ***one of ordinary skill in the art of making semiconductor devices*** to determine the workable or optimal ranges for the voltage and current applied during both the electrochemically reducing and depositing step through routine experimentation and optimization to obtain optimal or desired device performance because the voltage and current applied during both the electrochemically reducing and depositing step are result-effective variables and there is no evidence indicating that the voltage and current applied during both the electrochemically reducing and depositing step are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

4. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693).

Lu teaches a method of metallizing a substrate, comprising (See page 1, paragraph [0012] to page 2, paragraph [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 (See paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer in an electrochemical reaction cell comprising an anode formed from a material that can be oxidized in the presence of the material comprising the dual-purpose layer (See paragraph [0019]; and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer (See Paragraph [0022]).

Lu fails to teach where in the anode is formed from titanium or titanized platinum as recited in present claim 11. However, the use of titanium or titanized platinum in forming the anode is well-known to ***one of ordinary skill in the art of making semiconductor devices.***

5. Claims 15-24, 28-32, 34, and 36-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693) in view of Ho et al. (U.S. Patent 6,261,954).

Lu teaches a method of metallizing a substrate, comprising (See page 1, paragraph [0012] to page 2, paragraph [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 (See paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte and a first anode in a first electrochemical reaction cell

wherein the first anode comprises a material that can be oxidized in the presence of the material comprising the dual-purpose layer (See paragraph [0019]; and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer utilizing a second electrolyte and a second anode in a second electrochemical reaction cell (See Paragraph [0022]);

The above method wherein the electrochemically reducing step and the electrochemically depositing step can also performed in a single electrochemical reaction cell and are performed using a single anode and wherein at least one of the electrolytes comprises the cation of the material from which the conductive interconnect layer is made a complexing agent (boric acid H_3BO_3) and a pH control agent (tetramethyl amnonium hydroxide $(CH_3)_4NOH$);

Lu fails to teach wherein the dual-purpose layer comprises tungsten as recited in present claims 20-21.

Ho teaches a dual-purpose layer 18 comprises tungsten. (See col. 3, lines 30-41 and FIG. 6). ***It would have been obvious to one of ordinary skill in the art of making semiconductor devices*** to incorporate Ho's teaching into Lu's method because in doing so the dual-purpose layer comprises of tungsten can eliminate out-diffusion of copper ions from the interconnect (See col. 3, lines 30-41).

Lu fails to teach where in the anode is formed from titanium or titanized platinum as recited in present claim 11. However, the use of titanium or titanized platinum in forming the anode is well-known to ***one of ordinary skill in the art of making semiconductor devices.***

Lu fails to teach the ranges of the voltage and current applied during both the electrochemically reducing and depositing step as recited in present claims 28-31.

However, it would have been obvious to ***one of ordinary skill in the art of making semiconductor devices*** to determine the workable or optimal ranges for the voltage and current applied during both the electrochemically reducing and depositing step through routine experimentation and optimization to obtain optimal or desired device performance because the voltage and current applied during both the electrochemically reducing and depositing step are result-effective variables and there is no evidence indicating that the voltage and current applied during both the electrochemically reducing and depositing step are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Lu teaches that the electrolyte exhibits a pH greater than about 4 but fails to teach the pH control agent ranges as recited in present claims 38-41.

However, it would have been obvious to ***one of ordinary skill in the art of making semiconductor devices*** to determine the workable or optimal ranges for the pH control agent through routine experimentation and optimization to obtain optimal or desired device performance because the pH control agent is result-effective variables and there is no evidence indicating that the pH control agent is critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

6. Claims 42-44, 46, and 48-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693) in view of Ho et al. (U.S. Patent 6,261,954).

Lu teaches a method of metallizing a substrate, comprising (See page 1, paragraph [0012] to page 2, paragraph [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 (See paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte and a first anode in a first electrochemical reaction cell wherein the first anode comprises a material that can be oxidized in the presence of the material comprising the dual-purpose layer (See paragraph [0019]; and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer(See Paragraph [0022]);

The above method wherein the electrochemically reducing step and the electrochemically depositing step are performed in a electrochemical reaction cell utilizing a electrode and wherein the electrolyte comprises the cation of the material from which the conductive interconnect layer is made a complexing agent (boric acid H_3BO_3) and a pH control agent (tetramethyl amnonium hydroxide $(CH_3)_4NOH$);

Lu fails to teach wherein the dual-purpose layer comprises tungsten as recited in present claim 43.

Ho teaches a dual-purpose layer 18 comprises tungsten. (See col. 3, lines 30-41 and FIG. 6). ***It would have been obvious to one of ordinary skill in the art of making semiconductor devices*** to incorporate Ho's teaching into Lu's method because in doing

so the dual-purpose layer comprises of tungsten can eliminate out-diffusion of copper ions from the interconnect (See col. 3, lines 30-41).

Lu fails to teach the ranges of the voltage and current applied during both the electrochemically reducing and depositing step as recited in present claims 54-57.

However, it would have been obvious to ***one of ordinary skill in the art of making semiconductor devices*** to determine the workable or optimal ranges for the voltage and current applied during both the electrochemically reducing and depositing step through routine experimentation and optimization to obtain optimal or desired device performance because the voltage and current applied during both the electrochemically reducing and depositing step are result-effective variables and there is no evidence indicating that the voltage and current applied during both the electrochemically reducing and depositing step are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Lu teaches that the electrolyte exhibits a pH greater than about 4 but fails to teach the pH control agent ranges as recited in present claims 49-53.

However, it would have been obvious to ***one of ordinary skill in the art of making semiconductor devices*** to determine the workable or optimal ranges for the pH control agent through routine experimentation and optimization to obtain optimal or desired device performance because the pH control agent is result-effective variables and there is no evidence indicating that the pH control agent is critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective

variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Allowable Subject Matter

7. Claims 12-14, 25-27, 33, 35, 45, and 47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
October 4, 2002

LONG PHAM
PRIMARY EXAMINER